

RADIOLOGICAL DEFENSE PREPAREDNESS



**DEFENSE CIVIL PREPAREDNESS AGENCY
DEPARTMENT OF DEFENSE**

R A D I O L O G I C A L
D E F E N S E
P R E P A R E D N E S S

This Civil Preparedness Guide (CPG 2-6.1) supersedes the following Federal Civil Defense Guide (FG) publications which are obsolete and may not be used:

- FG D-2.3 Requisitioning and Handling Radiological Monitoring Instruments for Shelters
- FG E-5 Radiological
- FG E-5.1 RADEF Fundamentals
- FG E-5.2 RADEF Plans and Organization
- FG E-5.5 Radiological Reporting Procedures
- FG E-7 Decontamination
- FG E-7.1 Decontamination and Related Countermeasures

Defense Civil Preparedness Agency
Department of Defense

PREFACE

The Civil Preparedness Guide (CPG) 2-6 Series has been designated for Radiological Defense (RADEF) publications. Radiological Defense guidance published in other CPG's is not repeated but is referenced in CPG 2-6.1 so that published material can be readily located. CPG 2-6.1 describes the overall RADEF Program, the RADEF System, and their relationship to other areas of civil preparedness - in particular, Nuclear Civil Protection Planning, Direction and Control, Emergency Services, and Decontamination. The other publications in this Series provide more detailed information and guidance on various portions of the RADEF Program.

Radiological Defense publications currently scheduled are:

2-6.1	Radiological Defense Preparedness
2-6.2	Radiological Defense Manual ^{1/}
2-6.2.1	Guidance for Shelter Monitoring ^{2/}
2-6.2.2	Handbook for Radiological Monitors ^{3/}
2-6.2.3	Handbook for Aerial Radiological Monitors ^{4/}
2-6.2.4	Handbook for Fallout Forecasting ^{5/}
2-6.3	Radiological Defense Training

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- ^{1/} Supersedes Radiological Defense Textbook, SM-11.22-2 which may be used
^{2/} Redesignation of MF-72 when reprinted
^{3/} Supersedes FG-E-5.9 which may be used
^{4/} Supersedes FG-E-5.9.1 which may be used
^{5/} Supersedes FG-E-5.6 and FG-E-5.6.1 which may be used

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Chapter 1
Introduction

The radiation threat to a jurisdiction from a nuclear attack is very different from the events that usually threaten a community; e.g., fire, flood, tornado, or hurricane. The detection of, and countermeasures for, the radiation hazards from nuclear attack require special instrumentation and specially trained personnel - both of which are normally not available within a jurisdiction and especially in the numbers that would be required. Therefore, a Radiological Defense (RADEF) Program is necessary to provide the jurisdiction with the plans, procedures, instrumentation, facilities and trained personnel combined into a complete operational RADEF system that can function to minimize the effect of the radiation hazards in the event of a nuclear attack.

The elements of an operational civil preparedness RADEF system can also be utilized in peacetime radiological emergencies. There should be a written understanding regarding the role of the civil preparedness organization with other organizations that have responsibility for response to peacetime radiological emergencies.

Chapter 2
Policy

The Defense Civil Preparedness Agency (DCPA) shall develop and execute, in coordination and cooperation with Federal, State, and local governments, a radiological defense program to develop systems to monitor and analyze the radiological hazards of a nuclear attack.

DCPA shall assist State and local governments in developing a Radiological Defense Program that provides for the following:

- A. Shelter monitoring to assess and evaluate the protection of the shelter occupants against fallout radiation.
- B. Radiological detection and analysis as part of each State or local Emergency Operations System that includes Weapons Effects Reporting.
- C. Radiological monitoring for self-protection of personnel engaged in emergency services functions and the operation of vital facilities.
- D. Recovery operations, including decontamination and related countermeasures.
- E. Exposure control of personnel engaged in recovery operations.
- F. Statewide serial radiological monitoring to provide radiation data on large areas or areas with high radiation intensities.

Chapter 3
Purpose

This Civil Preparedness Guide (CPG) describes the DCPA Program to assist State and local civil preparedness directors/coordinators in developing within their jurisdictions a complete RADEF program. The major objectives of a RADEF Program are to save lives, minimize radiation injury, and reduce loss of property that would result from radioactive fallout in the event of a nuclear attack upon the United States.

While a RADEF program is required at all levels of government - National, Regional, State and local - the emphasis is on developing in each community a RADEF system to provide an emergency operational capability at the local level. The RADEF program at the State level must be supportive of local programs and ensure an effective and efficient response by local jurisdictions.

It is important to differentiate between RADEF programs and RADEF systems. A program is the means by which systems are developed, implemented, exercised, and maintained. A RADEF program is necessary to provide the plans, procedures, instrumentation, facilities, and trained personnel combined into a complete operational RADEF system that can function in an organized manner during an emergency to minimize the effect of the radiation hazard in the event of a nuclear attack. A system includes an emergency response capability or group of emergency response capabilities with a common mission. Thus, a RADEF system is that part of the total emergency preparedness system that provides for (1) detection, measurement, and exposure control of the radiation hazard, (2) selective reporting of radiological information to higher authorities, (3) evaluation and assessment of the hazard, and (4) application of appropriate countermeasures.

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Chapter 4 Background

RADEF is not an isolated program. It is an inherent and integral part of all the programs and systems which collectively provide a means for surviving the effects of a nuclear attack. It is a major element in the Nuclear Emergency Operations Plan, Emergency Operations Procedures, and Nuclear Civil Protection Planning.

The Nuclear Emergency Operations Plan is the broad basic plan. This plan is relatively brief: it establishes the overall framework of authorities, emergency operational concepts, and responsibilities; assigns missions and functional responsibilities to local departments and to nongovernmental groups with emergency capabilities; establishes the local emergency organizations under direction of the chief executive; and references or includes mutual-aid plans and procedures for requesting military or other State or Federal assistance. It provides the legal basis for a locality to conduct coordinated operations, using all manpower and resources of or made available to that level of government.

Appropriate Emergency Operations Procedures or annexes expand and supplement the Nuclear Emergency Operations Plan. They describe the functions, resources, and responsibilities with more detail and specifics listed for each responsible organization that will conduct emergency operations in the event of a nuclear attack. They describe the role for each of the emergency services, such as police, fire, rescue, public works, medical, and welfare as well as for industry and labor.

Nuclear Civil Protection (NCP) Planning considers the direct effects of nuclear weapons for high-risk areas, as well as fallout protection for both the high-risk areas and other areas of the Nation. Local-level NCP planning involves the assignment or "allocation" of the population of each high-risk area to appropriate locations in host areas that have been designated in the State-level plan. Detailed procedures will be developed for each of the host jurisdictions concerning the reception and care of the relocatees and the provision for shelter from fallout. Planning for risk areas involves identifying necessary shelter from both direct weapons effects and fallout radiation for those essential personnel remaining in or commuting to risk areas. Detailed plans will also be developed for all risk, host, and other areas identifying fallout shelters for the populace at or near their place of residence for use in the event of an attack with short warning or if relocation plans are not implemented.

Chapter 5
RADEF Program Support by DCPA

State and local RADEF program development and implementation, as well as maintenance and improvement, are made possible by national support in the following areas:

5.1 Guidance - Guidance for use by State and local jurisdictions is published as Civil Preparedness Guides (CPG's), Civil Preparedness Circulars (CPC's) and Technical Reports (TR's). Civil Preparedness Guide Series 2-6 has been designated for publication of material primarily directed to RADEF personnel. Publications currently scheduled in this series are listed in the Preface of this publication. The following CPG's (other than the CPG 2-6 series), CPC's, and TR's listed in MP-20, the DCPA Publications Catalog, are particularly applicable to RADEF:

<u>Identifier</u>	<u>Title</u>
CPG 1-3	Federal Assistance Handbook
CPG 1-5	Standards for Local Civil Preparedness
CPG 1-5A	Local Program Paper Handbook
CPG 1-6	Disaster Operations - A Handbook for Local Government
CPG 1-14	Civil Preparedness Principles of Warning
CPG 1-18	Emergency Communications
CPC 2-1A	DCPA Attack Environment Manual, Chapters 1 through 9
CPG 2-4	Civil Preparedness Exercise Program Guidance
CPC 2-8	Crisis Relocation Contingency Planning (Series)
CPG 2-9	Manual Damage Estimation System
CPG 2-10	Civil Defense Emergency Operations Reporting Systems (Series)
CPG 2-11	CAP Support for Emergency Preparedness
CPC 72-3	Radiological Monitoring Program: Implementation of Memorandum of Understanding Between USDA and DCPA
CPC 74-8	Memorandum of Understanding Between DCPA and Civil Air Patrol (CAP)
CPC 75-4	Nuclear Civil Protection Planning
CPC 77-1	Accidental Launch Warning
CPC 77-6	Recommended Procedures for Use of Shelters for Protection from the Effects of Nuclear Weapons
TR-61	EMP Threat and Protective Measures
TR-71	Decontamination Considerations for Architects and Engineers
TR-82	High Risk Areas

The National Council on Radiation Protection and Measurements (NCRP) was requested to provide information as to the radiation exposures that

might be acceptable in several categories of civil defense work under emergency conditions. The NCRP recommendations were issued November 15, 1974 as NCRP Report No. 42, Radiological Factors Affecting Decision-Making in a Nuclear Attack. Copies of this report are available as stated in MF-20.

5.2 Radiological Equipment - Instrumentation to detect and measure radiation is federally procured. Quantities sufficient to provide a reasonably adequate level of readiness for protection of the population in the event of a nuclear attack has been granted to each State.

Through a federally funded program, RADEF instrumentation is maintained and calibrated as necessary by the States to assure operational readiness and mission reliability. A seven-volume "Repair and Maintenance Manual for Civil Defense Radiological Instruments," supplemented with periodic "Radiological Instrument Maintenance and Calibration Memorandums," are provided to the State Maintenance and Calibration facilities. An engineering program supports the development, procurement, and maintenance of RADEF equipment. The engineering program assists in the maintenance of the existing equipment, and is developing improved, low-cost instrumentation for future procurement.

5.3 Training - DCPA develops curricula for RADEF training, and updates the curricula and supporting training materials as required. Instructor Guides (IG's), Student Manuals (SM's), and visual aids - either slides and/or 16mm movies are made available for RADEF training courses. The following publications are available:

<u>Identifier</u>	<u>Title</u>
MS-3	Introduction to Radiological Monitoring - Home Study Course
K-24	Radiological Monitoring Training Kit
SM-11.21.1	Radiological Monitoring Student Workbook
IG-11.24	Aerial Radiological Monitoring Instructor Guide
SM-11.25	Basic RDO Student Manual
SM-11.25.1	Basic RDO Quizzes and Examination
IG-11.25	Basic RDO Instructor Guide
SM-11.26	Advanced RDO Student Manual
IG-11.26	Advanced RDO Instructor Guide
SM-11.27	RADEF Instructor Workshop Student Manual
IG-11.27	RADEF Instructor Workshop Instructor Guide

Through a federally funded program, technical RADEF training is provided for Radiological Monitors, Aerial Radiological Monitors, Radiological Defense Officers, and Instructors. Radiological Monitor training packages are also being developed to provide accelerated monitor training for use during a crisis period for all monitors for shelters and for additional monitors for expanded operational monitoring and reporting systems, including Waspoos Effects Reporting Stations (WERS) and for self-protection monitoring.

5.4 Fallout Forecasting - The National Weather Service maintains a network of weather observatories where the direction and speed of the wind from the earth's surface to high altitudes above the surface is determined. Calculations are made for particles originating at the 100-millibar level (approximately 53,000 ft.) and falling to the earth's surface. Downwind fallout forecast data (DF) for projected meteorological conditions are then prepared for some 100 locations in the continental United States and 30 locations in Alaska, Hawaii, Puerto Rico and Canada. The data are used in forecasting likely fallout areas and estimating expected fallout arrival times for downwind areas. The data are distributed twice daily over the Federal Aviation Administration (FAA) Teletypewriter Service C. DCPA furnishes the data to all State Civil Defense Offices for use in tests and exercises and in the event of nuclear attack on the United States.

DCPA, through the eight Regional Offices and two Regional Field Offices, provides each State with guidance and assistance, as feasible, for effective application of DCPA resources to emergency operations in the event of nuclear attack.

Chapter 6
RADEF Program Implementation

6.1 Requirements - Implementation of a local RADEF program requires that:

- a. A Radiological Defense Officer be selected, assigned and trained.
- b. Plans and procedures be developed.
- c. Radiological equipment be obtained and distributed for use throughout the jurisdiction.
- d. Personnel be trained to use the radiological equipment for their own protection, as well as to provide radiological information to a central collection point.
- e. A single location be designated for direction and control of monitoring operations.
- f. Communications be arranged for, and reporting procedures established.
- g. Procedures be established for analyzing and presenting (in most cases, displaying) collected information, for use in decision-making.
- h. A radiological decontamination capability be developed.
- i. Arrangements be made for radiological equipment inspection, maintenance, recalibration, and replacement when necessary.
- j. Periodic tests and exercises be conducted.
- k. Refresher training be provided periodically.
- l. Personnel be replaced as required to keep the RADEF emergency response capabilities effective.

6.2 Role of the Local Coordinator - The local coordinator should:

- a. Develop an understanding and knowledge of radiological effects. As a minimum, become familiar with (1) the information contained in the CPG 2-1A series of publications - and in particular, Chapter 6, entitled, "What the Planner Needs To Know About Fallout," and (2) Nuclear Civil Protection Planning (NCP) for the jurisdiction and adjacent surrounding areas.

b. Develop a radiological monitoring capability for shelterees in the jurisdiction. This should be achieved by (1) obtaining RADEF instruments from the State for each public shelter, (2) placing these instruments in the shelters or in nearby secure repositories, with a plan for their distribution in a crisis, and (3) providing for the crisis training of shelter radiological monitors. This should be accomplished without waiting for the development and implementation of a complete RADEF Annex.

c. Give priority attention to selecting, assigning and training a qualified Radiological Defense Officer (RDO) who will assist in the planning, development, and implementation of a detailed RADEF program. With or without the assistance of a qualified RDO, the civil defense coordinator should establish a complete RADEF program, using guidance in the CPG 2-6 series, and the criteria provided in CPG 1-3, "Standards for Local Civil Preparedness."

d. Support and assist the RDO in continuing the maintenance, exercising, testing, evaluation, updating, and improvement of all aspects of the RADEF program - including personnel, equipment, facilities, and procedures. Continuous attention should be given to plans and procedures for crisis augmentation of all systems not fully implemented for maximum effectiveness of operations in the event of a nuclear attack.

6.3 Role of the Local Radiological Defense Officer (RDO) - More than one local RDO is required in most jurisdictions. However, the first RDO trained should be "Systems" oriented. This RDO should be the type that can assist the local coordinator in establishing a complete RADEF system. This means that the RDO should be able to plan, assist in writing procedures, and be a prime mover in the deployment of a viable radiological defense emergency response capability.

A major task of a local RDO is to ensure that all public shelters which are included in the local MCP plan are provided with suitable sets of instruments. The public shelter is the first line of radiological defense for the citizen. Instrumenting these shelters is most essential, especially the lower grade shelters. Shelterees require instrumentation in order to fully utilize the protection afforded by these lower grade shelters and to be able to increase the value of this protection by every expedient means available to them.

In order to get a local RADEF system fully operational, local personnel must be trained as monitors for weapons effects reporting stations and for the self-protection of emergency services, industries, and vital facilities personnel. The local RDO should normally provide this training. However, if the RDO cannot provide this training, the help of someone locally to conduct it should be enlisted. Local RDO's should also assist

the local coordinator in the development of plans for the crisis training of radiological shelter monitors, additional operational radiological monitors for weapons effects reporting and self-protection, and the additional personnel required to assist in the EDC. Training during a period of international tension is the primary means of training shelter monitors.

The local RDO must not only assist in planning for and the deployment of a RADEF system, but must assist in maintaining and exercising the system. To this end, the local RDO should see that local personnel who are trained as radiological monitors continue to familiarize themselves with their instruments and procedures. Familiarization with the instruments can now be achieved in conjunction with the Statewide maintenance and calibration programs by getting trained monitors involved in the periodic operational testing of all of the localities' radiological instruments.

In peacetime, the local RDO is the keystone of the locality's radiological readiness. The local coordinator needs the help of a competent, systems-oriented RDO in order to develop and maintain a viable radiological defense system in the jurisdiction.

In wartime, the local RDO is responsible for the assessment and analysis of radiological situations in the community. The RDO is responsible for making technical recommendations for remedial actions which can be taken in a radiological environment. The RDO must be familiar with radiological measurement and reporting procedures; capable of evaluating the probable effects of radiation on people and other resources; and capable of recommending appropriate protective actions such as remedial movement, shelter and decontamination.

The mission and functions of the local RDO are summarized as follows:

6.3.1 Mission:

The Radiological Defense Officer (RDO) is the principal technical advisor to the Civil Preparedness Director/Coordinator and to the Head of government (of any jurisdiction) on matters pertaining to radiological defense against nuclear attack. Under certain conditions, the RDO may also have assigned responsibilities for peacetime radiological emergency response (PRER).

6.3.2 Functions:

a. Preattack: RDO's serve on the staff of the Director/Coordinator assisting in the planning, development and maintenance of the State/local RADEF systems. The preattack duties of the RDO include the following:

- (1) Preparation and updating of the RADEF annex to the emergency plan.

- (2) Implementation and exercise of the RADEF annex.
- (3) Recruiting, training, assignment and exercising of personnel for a weapons effects reporting network.
- (4) Recruiting, training and exercising of radiological personnel for emergency services and vital facilities.
- (5) Obtaining and providing for maintenance of requisite radiological equipment.
- (6) Planning for and implementing all aspects of crisis augmentation of the RADEF system.
- (7) Participating in public information and education programs.
- (8) Planning for the dual use of the RADEF system for Peacetime Radiological Emergency Response (PRER).

b. Trans and Postattack: RDO's serve in the EOC and, under certain conditions, within emergency services and vital facilities as technical advisors to decision makers and as chief of the Attack Analysis (or equivalent) staff of the EOC. The trans and postattack duties of the RDO include:

- (1) Collection and analysis of radiological data.
- (2) Presentation of radiological intelligence to the decision maker in a form suitable for use in making decisions affecting safety of the public and emergency service and vital facility personnel.

6.3.3 Radiological Skills and Knowledge Required:

a. Preattack:

- (1) RADEF system requirements.
- (2) Federal guidance and assistance available to States and localities and procedures for obtaining this assistance.
- (3) How to develop the RADEF annex.
- (4) How the RADEF system may be applied to PRER.

b. Trans and Postattack:

- (1) Knowledge of the complete RADEF annex and status of its implementation.

- (2) Radiation fundamentals.
- (3) Biological effects of radiation.
- (4) Radiological self protection.
- (5) Monitoring techniques.
- (6) Countermeasures for fallout radiation.
- (7) Principles of attack analysis.
- (8) Decontamination techniques.
- (9) Roles of emergency services and vital facilities in survival and recovery plans.

Chapter 7
The RADEF System

7.1 System Description - A complete, operationally ready RADEF system must include the following:

- a. A shelter radiological monitoring capability for monitoring and assessing the radiation environment for shelterees. It is necessary (1) to find the best protected locations in the shelter where the exposure rate is lowest; (2) to evaluate shielding improvements made in the shelter; (3) to measure and control or limit the radiation exposure to the shelterees; and (4) to determine when short excursions can be made outside the shelter for essential items such as food, water, and medical aid.
- b. A self-protection radiological monitoring capability for monitoring and assessing the radiation environment to control or limit the radiation exposure of personnel who must conduct emergency operations under fallout conditions. This capability is required for personnel in emergency services organizations, at vital facilities, including hospitals, utilities, and essential industries, and for the large number of additional emergency workers who would be required for postattack recovery operations. It is necessary (1) to measure actual exposure rates at the location where emergency operations are being conducted to confirm or revise radiation exposure rate estimates; (2) to evaluate how long personnel can work there without exceeding established exposure limits; and (3) to measure and control or limit the actual radiation exposure to personnel performing emergency operations.
- c. A monitoring, reporting and assessment capability for determining the extent and magnitude of the radiological hazard throughout a given jurisdiction. This capability is required to determine (1) if and when emergency operations can be initiated; (2) when lower grade shelters may be used; (3) when people - emergency workers or any others being sheltered - may go outside of shelters; (4) when restrictions in shelter living may be relaxed; and (5) when radiological countermeasures should be undertaken. It is necessary to (1) measure actual exposure rates at selected, geographically distributed locations throughout the jurisdiction; (2) collect this information at a central location; (3) process, display, and analyze the radiological hazard; (4) arrange for supplementing the data provided routinely from the selected locations, or substituting for their data where missing; and (5) provide simplified summaries of the status of the radiological hazard for the general public and (6) provide summaries of the local radiological situation to higher echelons and other communities in accordance with agreed-upon procedures.

d. A radiological decontamination capability for reducing the radiation levels from fallout contamination to acceptable levels. This capability is required to (1) avoid skin burns to individuals; (2) allow earlier use of essential facilities, and (3) reduce radiation exposure to personnel sheltered in, or required to work in, vital facilities or industries. It is necessary to: (1) measure actual exposure rates at each location where decontamination is being considered; (2) evaluate the various methods of removing or covering the radioactive fallout; (3) if feasible, select the method that will require least expenditure of labor and materials, and which will hold radiation exposure of decontamination personnel to a minimum; and (4) measure exposure rates during and following decontamination operations. It is emphasized that decontamination is not a substitute for shelter during the early postattack period.

Each capability described as part of the RADEF system is also an integral portion of other systems. For example, a RADEF shelter monitoring capability must be regarded as a support capability of any shelter system. The RADEF monitoring, reporting, and assessment capability is an integral part of direction and control for emergency operations management. Similarly, self-protection monitoring, including radiation exposure control and decontamination, must be included as part of any emergency services system. This concept of an integrated RADEF system should be kept in mind by all responsible national, regional, State, and local officials in planning and implementing systems for defense against nuclear attack.

7.2 System Components

a. General

(1) The RADEF system requires the following components, which are part of all emergency operational systems:

Procedures	Personnel
Facilities	Training
Equipment	Tests and Exercises

(2) Operational readiness is the ultimate goal of all emergency operational systems for all State and local government organizations. An emergency organization must be established, based on legal authority. Then emergency operations plans and procedures must be prepared with assignments of responsibility. Individuals must be recruited for emergency assignments, emergency rosters must be developed, and personnel made aware of their emergency duties. Specialized orientation and training must be given, as necessary. Emergency plans should be periodically tested, exercised, and updated. Facilities, equipment, and supplies essential to emergency operations must be provided. Key elements are Emergency Operating Centers and emergency communications capabilities.

b. Procedures

(1) Each jurisdiction requires RADEF Operational Procedures. These are usually contained in a RADEF Annex to the Nuclear Emergency Operations Plan. The RADEF Annex describes the jurisdiction's plan of action for establishing and maintaining a RADEF system within the jurisdiction.

(2) RADEF procedures are the first priority item for establishing a viable RADEF system. In order for any system to function effectively, there must be procedures that describe how people, facilities, and equipment will be utilized. The RADEF procedures tell who, what, when, where, and how all the capabilities of a RADEF system will operate in an emergency and how they interrelate with other emergency operations systems. The procedures should provide enough detail so that someone relatively unfamiliar with the system could still effectively operate in an emergency.

(3) The RADEF operations procedures should also identify those activities that are maintained in an operationally ready mode on a day-to-day basis; and those activities that are to be implemented during a period of increased readiness.

(4) The development of the necessary detailed procedures for a complete RADEF system requires a person at each level of government who is trained in RADEF and designated as the Radiological Defense Officer; and who, together with the Director/Coordinator, is responsible for the development and implementation of the RADEF system.

c. Facilities

(1) Included in the RADEF system are several types of facilities, many of which are components of other emergency response systems.

(2) The shelter is the primary countermeasure to protect the population of the jurisdiction from the effects of radiation. Some shelters protect people with specific radiological defense-oriented missions (e.g., a weapons effects reporting station or an Emergency Operating Center).

(3) Local instrument bulk repositories are facilities where RADEF instruments assigned to a jurisdiction are stored in quantity for distribution during a period of increased readiness.

(4) Each State has or is provided the services of a maintenance and calibration facility for radiological instrument maintenance, calibration, and repair.

(5) Emergency Broadcast System stations, hospitals, facilities with NAWAS drops, and other communication centers should be included as weapons effects reporting stations.

d. Equipment

(1) Equipment includes any instruments and supplies required by the RADEF system to perform its mission.

(2) Radiological monitoring instruments are needed to detect and measure nuclear radiation. These are special types of instruments not normally available within a jurisdiction in the numbers that would be necessary in event of nuclear attack. Therefore, DCPA has procured large quantities of radiological instruments and granted them to the States for distribution to local jurisdictions. Several different types of instruments are usually issued as a set. An appropriate set of instruments is available for each type of use. The various types of sets and their components are listed in Table I.

(3) A weapons effects reporting network requires the use of communications. Most jurisdictions have fairly extensive communication systems that use two-way radio, such as fire, police, taxi, public works, game and fish, and many industries. Maximum use should be made of these systems.

(4) The maintenance, calibration, and repair of the RADEF instruments issued to State and local jurisdictions is provided through the State maintenance and calibration facility. The facilities are 100 percent federally funded by DCPA to maintain the instruments at an acceptable level of operational readiness and reliability. These services are available to localities through the State civil preparedness agency.

(5) At local level, the RADEF instruments are to be inspected and an operational check performed in accordance with procedures established by the State. The State arranges for the replacement of instruments found defective.

e. Personnel

(1) The RADEF system requires several types of personnel to perform various duties. These include: A Radiological Defense Officer (RDO) who is in charge of the overall RADEF program, and under emergency conditions is responsible for analyzing and evaluating radiological data; an EOC RADEF staff to assist the RDO; Radiological Monitors (RM's); Aerial Radiological Monitors (ARM's); and instructors to provide the required training for these various personnel.

Table 1

Recommended Composition of RADEF Instrument Sets

Set Type	Quantity and Type of Instruments in Set				
	CD V-700	CD V-715	CD V-717	CD V-742 ^{6/}	CD V-750
CD V-777 ^{1/}	1	2 ^{2/}	0	6	1
CD V-777A ^{3/}	1	1	1	6	1
CD V-777-1 ^{3/}	1	1	0	6	1
CD V-777-2 ^{4/}	0	1	0	6	1

^{1/} Standard set recommended for emergency service and vital facility self-protection monitoring.

^{2/} Standard set recommended for surface monitoring and reporting stations.

^{3/} Alternate set for emergency service organization use.

^{4/} Standard set recommended for public shelters.

^{5/} In some 777 sets, there may be one CD V-715, and one CD V-720 -- such as for aerial monitoring support.

^{6/} RADEF instrument sets issued prior to 1978 contained two dosimeters per set. Some sets have CD V-730 or CD V-740 dosimeters. Starting in 1978, it is recommended that newly assembled sets each contain six dosimeters and provision be made systematically to increase the number of dosimeters from two to six in all sets processed.

(2) RADEF personnel - Radiological Defense Officers, Aerial Radiological Monitors, Instructors, and some Radiological Monitors - must be assigned and trained well in advance of an emergency so they are ready to perform their duties if a nuclear attack occurs with little or no advance warning.

(3) Shelter Radiological Monitors and decontamination personnel would only be trained during an increased-readiness period. Other RADEF personnel - supplemental Radiological Monitors, Aerial Radiological Monitors, and EOC RADEF staff - would be trained during a period of increased-readiness, or would receive on-the-job training.

f. Training

(1) RADEF is unique because it requires personnel specifically trained to function in a capacity significantly different from normal occupations. For example, most emergency services and vital facility personnel would function during an emergency in their normal occupations (e.g., police, fire, hospital, and utility personnel) or as trained volunteers (e.g., volunteer firemen and RACES operators). However, RADEF personnel, particularly the radiological monitors, normally have daily occupations, such as those listed above, that require radiological defense as an extra duty. Even radiological technicians in hospitals, health department laboratories, and industry require additional training in radiological defense. This is because the exposure criteria and radiation protection guidelines for the nuclear attack environment vary greatly from the guidelines for normal peacetime operations and peacetime emergencies.

(2) Following initial training, RADEF personnel require periodic refresher training to maintain technical skills and to keep them aware of any changes in techniques and/or procedures. Refresher training may be in the form of formal classroom or field work, tests, exercises, or seminars.

(3) DCPA has developed a comprehensive training program to train Radiological Defense Officers, Radiological Monitors, Aerial Radiological Monitors, and Instructors. The training program is funded by DCPA and provides training at the local, State, and Regional level - depending upon the type of training and the technical and quantitative requirements for each type of training. Civil Preparedness Guide, CPG 2-6.3, Radiological Defense Training, lists the types of training required by personnel performing various functions within the RADEF system. CPG 2-6.3 also lists the different courses available, the length of the course, the prerequisites, and a brief description of course content.

g. Tests and Exercises

Any system that relies on trained personnel must be periodically tested and exercised to assure its ability to function in an emergency.

The RADEF system is no exception. The entire RADEF system and each of the capabilities should be periodically exercised to evaluate the RADEF operational procedures and to maintain the technical competency of the trained RADEF personnel. (See CPG 2-4, Civil Preparedness Exercise Program Guidance.)

7.3 Shelter Radiological Monitoring Capability

- a. The shelter radiological monitoring capability provides people in public shelters with the means to detect, measure, and assess the radiation hazards from fallout following a nuclear attack. By using this information, necessary remedial actions can be determined. The shelter is the primary countermeasure in the RADEF system to protect people from radiation.
- b. The Standards for Local Civil Preparedness (CPG 1-5) prescribe the procedures, equipment, and training required for an operational shelter radiological monitoring capability.
- c. The shelter program is developed as part of the Nuclear Civil Protection (NCP) Plan. Therefore, the RADEF shelter radiological monitoring capability must be developed in consonance with the NCP plan for the jurisdiction. This is further discussed in Chapter 8, Radiological Defense Support for Nuclear Civil Protection. Chapter 8 also contains an operational checklist that should be used by both RADEF and NCP planners for implementing the shelter radiological monitoring capability.

7.4 Self-Protection Radiological Monitoring Capability

- a. The self-protection radiological monitoring capability provides personnel in emergency services, vital facilities, and essential industries with the ability to conduct radiological monitoring for their own protection. It includes a means to monitor and control the radiation exposure of emergency workers who would be engaged in postattack recovery operations.
- b. The emergency services, vital facilities, and essential industries that require a self-support capability include organizations and units such as the following:

Police	Highway Maintenance	Gas Companies
Fire	Water and Sewage Plants	Food and Drug Processing
Rescue	Telephone Facilities	Industries
Hospitals	Power Plants	State and Local Offices of Federal Agencies

In a nuclear attack emergency, personnel of these organizations require the capability to perform independent radiological monitoring in support of their emergency activities - hence, the term "self-protection." These units would not routinely report radiological data to an Emergency Operating Center (EOC). However, they should receive radiological and operational information from the EOC in conjunction with emergency assignments; and the EOC may request radiological information on certain areas during the course of emergency operations.

c. Large numbers of emergency workers would be needed for post-attack recovery operations. Since these personnel would be working in a radiation environment, radiological instruments, trained monitors, and personnel dosimetry would be needed to limit their radiation exposure. During recovery operations, monitors and equipment from shelters, from self-protection monitoring, and weapons effects reporting stations should be reassigned to support emergency workers by (1) providing surveys of the work area; (2) monitoring the effectiveness of decontamination; (3) limiting radiation exposures; and (4) providing other assistance as required.

d. CPG 1-5, Standards for Local Civil Preparedness, prescribes the equipment and training required for an operational self-protection radiological monitoring capability.

e. The self-protection radiological monitoring capability must be developed in consonance with the requirements of the emergency services, vital facilities, and essential industries, as stated in their respective annexes to the Basic Nuclear Emergency Operations Plan. This interrelationship is further discussed in Chapter 9, Radiological Defense Support for Emergency Services. Chapter 9 also contains an operational checklist that should be used by RADEF and Emergency Services personnel in implementing this capability.

7.5 Radiological Monitoring, Reporting and Assessment Capability

a. The radiological monitoring, reporting, and assessment (NR&A) capability provides the Emergency Operations Center (EOC) staff and decision-makers with current information on the radiation environment resulting from a nuclear attack. The NR&A capability includes:

- (1) An Emergency Operations Center (EOC).
- (2) Trained personnel for Radiological Assessment.
- (3) A network of Weapons Effects Reporting (WER) stations (also known as monitoring and reporting stations).
- (4) An Aerial Radiological Monitoring Network (State level).

b. The EOC, with its radiological assessment responsibility, is the focal point for radiological intelligence within the jurisdiction. The RADEF staff, based upon information received from the State, predicts the arrival of radioactive fallout in the jurisdiction. After fallout has arrived, exposure rate data are received from the individual WER stations. These data are analyzed to determine the radiation environment of the jurisdiction. Information on the radiation environment is forwarded to the State level in accordance with procedures established by the State. At local level, information on radiation levels is combined with other information and the combination is used by the EOC staff to determine what remedial actions or countermeasures are needed and how they may best be implemented.

c. The Weapons Effects Reporting (WER) network consists of a series of monitoring locations (WER stations) strategically located to provide the EOC RADEF Operations section with data on the exposure rate (radiation environment) throughout the jurisdiction. Most monitoring locations will be Weapons Effects Reporting Stations and will report nuclear detonations and/or the effects of detonations. The WERS locations should favor the sheltered population. They should be selected to maximize information in densely populated areas, as well as to give adequate geographic coverage, even in sparsely populated areas.

d. The serial radiological monitoring (ARM) network is part of the State RADEF Operations. Aerial radiological monitoring provides the State with the ability to survey relatively large areas, areas where no local monitoring capability exists, and/or areas where no data are available. Aerial radiological monitoring can also be used to survey evacuation routes, supply routes, etc., which may cover more than one local jurisdiction. Although the aerial radiological survey teams are part of the State RADEF System, they must be located at dispersed locations throughout the State. Aerial radiological monitoring could be used by a local jurisdiction to obtain RADEF information on remote areas within the jurisdiction, or areas where the WER network is not functioning. However, since ARM is part of the State system, this must be coordinated with State RADEF Operations.

e. An emergency public information capability provides for the dissemination of radiological information to people throughout the jurisdiction. For example, shelterees need information on the radiation environment, and guidance on emergence from shelter. Dissemination of RADEF information must be coordination with the Public Information Staff of the EOC.

f. CPG 1-5, Standards for Local Civil Preparedness, prescribes the equipment and trained personnel required for an operational monitoring, reporting, and assessment capability.

g. The monitoring, reporting, and assessment capability is an integral part of the EOC operations. Therefore, this capability must be developed in consonance with the Direction and Control program of emergency operations management. This interrelationship is further discussed in Chapter 10, Radiological Defense Support for Direction and Control. Chapter 10 also contains an operational checklist that should be used by RADEF and Direction and Control personnel in implementing this capability.

7.6 Radiological Decontamination Capability

a. The radiological decontamination capability includes any countermeasures that would be used by the jurisdiction to reduce the radiation exposure (environment) due to radiation from fallout. Postattack recovery operations will require that certain essential facilities and industries become operational as rapidly as possible. Facilities and industries that have no, or little, physical damage could become operational if the radiation environment is reduced to allow operating personnel to return without subjecting them to prohibitive radiation exposures.

b. The Basic Emergency Operations Plan should include an annex listing the essential facilities and industries in the jurisdiction, and a priority ranking for returning them to operational status. The annex should also contain a listing of the resources available within the jurisdiction for accomplishing decontamination. Such a listing of resources would include the various types of construction equipment, highway maintenance equipment, fire trucks, etc., and the number and locations of each item.

c. Plans should be developed indicating the decontamination procedures that could be used for each facility. These plans would include the estimated types and quantity of resource equipment needed and the number of personnel and work-hours required to accomplish the decontamination.

d. Plans should include the use of radiological monitoring teams and survey equipment from shelters, weapons effects reporting stations, and self-protection units to perform radiological surveys. These surveys will determine the need for decontamination and the adequacy of the decontamination procedures, as well as to control the radiation exposure of the emergency workers.

e. The Department of Public Works or other engineering departments of State and local governments should be assigned the major responsibility for developing and executing decontamination operations. The radiological decontamination capability must be developed in consonance with the responsible department. This interrelationship is further discussed in Chapter 11, Radiological Support for Decontamination. Chapter 11 also contains an operational checklist that should be used by RADEF and Public Works personnel in implementing this capability.

7.7 Relationship to Other Emergency Operations Systems

RADEF system capabilities are directly interrelated to other civil preparedness emergency operations systems. This interrelation for each capability is further discussed in Chapters 8 through 11 as follows:

<u>Chapter Number</u>	<u>Chapter Title</u>
8	Radiological Defense Support for Nuclear Civil Protection Planning
9	Radiological Defense Support for Emergency Services
10	Radiological Defense Support for Direction and Control
11	Radiological Decontamination

This CPG should be distributed to the appropriate program or emergency service with which RADEF has these interrelationships.

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Chapter 8
Radiological Defense Support for Nuclear Civil Protection

8.1 Discussion

The protection of the public against all weapons effects, including excessive radiation exposure from radioactive fallout, is the primary objective of Nuclear Civil Protection (NCP) planning. RADEF, in the context of NCP planning, must address the broad concepts of both in-place Community Shelter Planning (CSP) and Crisis Relocation Planning (CRP).

Shelterees should have the ability to (a) determine actual radiation levels in their shelter areas; (b) locate the best places in the shelter and (c) determine if the protected area needs improvement. The only way that shelterees can obtain information on how the radiation hazard is affecting them is by having radiological instruments in the shelter, and using them.

The shelter radiological monitoring capability is most important in the early shelter period. This is the time when radiation levels can be very high initially but decrease at a rapid rate. This period could extend from a few hours to a few days-postattack. This is also the period when the shelterees are most likely to be isolated, and have no communications with persons outside their own shelter. Thus, they are on their own to assess the radiological situation and to do something about it if necessary.

The Standards for Local Civil Preparedness (CPG 1-5) prescribe at least one set of instruments for every public shelter. These sets are available to local jurisdictions from the Federal Government through the States. The radiological instrument set currently being issued for public shelters is the CD V-777-2. It is composed of one CD V-715 high-range survey meter, six CD V-742 high-range dosimeters, and one CD V-750 charging unit for the dosimeters. Some shelters may require more than one set of instruments, dependent upon the shelter capacity and the number of floors dedicated to shelter use.

The numerical requirements for radiological instrument sets and for the number of radiological monitors that must be trained for shelter monitoring should be determined and provided for the DCPA Program Status Report. Providing in-shelter monitoring capability for local jurisdictions requires a cooperative effort between State and local planners. The cooperative effort should assure that instruments are made available for distribution in a crisis (sets of instruments should be placed in public shelter only in low-risk areas) and that crisis training of shelter monitors through a mass media is provided. To be effective, each jurisdiction must obtain instruments and develop a plan for (a) their storage in secure locations (referred to as local bulk repositories); (b) their distribution in a crisis period; and (c) the dissemination of required training in a crisis period. The jurisdiction must also

arrange for the periodic operational testing of these instruments in accordance with the State's schedule; and the exchange, with the State, of instruments that do not pass the operational test. The State will also provide for the periodic calibration of these instruments.

In planning for a two-option operation, either shelter in-place or relocation, it is important to identify all of the readiness actions that can be taken before a decision is made on which option to exercise. It is desirable to develop a plan which would put as many actions as possible into the predecision period. Generally, the plan should favor predecision actions which support shelter in-place, because that is the option related to the shortest warning time. More specific guidance is given below for the State and local levels:

a. State Plan

(1) State RADEF operations will not change appreciably, regardless of which option is chosen. However, the lower grade shelter implied by relocation would tend to reinforce the need for a manageable span of control in RADEF technical support to non-risk host county operations. That is, sub-State or district staffs should be developed to give RADEF advice and technical support to county RADEF Officers.

(2) If RADEF instruments are bulk-stored at State level, the allocation plan by county should be developed first for shelter in-place. This will allow the State to ship instruments during the earliest possible part of the increased-readiness period. However, the in-place allocation plan should be supplemented with a crisis relocation allocation plan as the CRP's are completed.

b. Risk County Plan

(1) The need for radiological data throughout the county exists in either option. In relocation, geographical coverage is needed to protect essential workers and provide intelligence to the State for recovery actions. Risk counties should, therefore, attempt to establish weapons effects reporting stations at essential worker or critical facility locations.

(2) Instruments for shelter monitoring should be stored in bulk repositories at local level from which they could be distributed to shelters, or relocated with evacuees, in proportion to numbers being relocated. Two plans should be developed, one to provide for distribution to shelters, and the other for distribution to the various host counties.

(3) Instruments for self-protection monitoring should be in the hands of emergency services and other essential users at all times. Instructions should specify that the crews that relocate take their instruments with them.

(4) Critical facilities would normally retain their instruments in either option.

(5) Instruments for emergency workers should be bulk-stored with the shelter instruments and distributed or relocated with them.

(6) In a risk county, the same EOC RADEF staff would be needed whether people are sheltered in-place or are relocated. Two complete staffs would be required to provide a 12-hour per shift capability.

c. Non-Risk County Plan

(1) The minimum Weapons Effects Reporting Station (WERS) network requirement remains the same for both options. It should be supplemented in non-risk areas where the risk area population will be relocated to the non-risk host area.

(2) The need for shelter instruments in the non-risk host area would increase dramatically. The EOC RADEF staff in a non-risk host area must be familiar with the non-risk host county shelter plans and should know how many instruments to expect from risk counties.

(3) The EOC RADEF staff should be informed as to which arriving self-protection crews have instruments.

(4) The EOC RADEF staff should also know the number of emergency worker instruments destined for their county.

(5) The EOC RADEF staff must be capable of expanding to meet the many demands of the increased population being sheltered.

8.2 Implementation Techniques

General guidelines such as those given above should help the local RADEF Officer proceed with a detailed plan tailored to the specific jurisdiction. A checklist for use in developing the shelter monitoring capability at the local level to support NCP is provided in 8.3. Additional specific guidance for a locality and other assistance must be obtained from the State level NCP planners. The methods by which the assistance is applied will vary among the States, and will depend heavily on whether the jurisdiction is a risk, non-risk or non-risk/host area. (See CPG 2-8 for discussion of risk, non-risk, or non-risk/host area.)

A Monitoring, Reporting, and Assessment (MRAA) capability, which is part of the Direction and Control System for conducting emergency operations, also provides information for shelterees. However, due to communication difficulties, for example: between the shelters and the EOC, radiological data may not be available to the shelterees until some hours postattack. Therefore, it cannot be depended upon when the shelterees need radiological information most, that is, in the earliest period of shelter occupancy. MRAA support is discussed in Chapter 10, Radiological Defense Support for Direction and Control.

8.3 Checklist

a. Procedures are required for:

- (1) Storage and servicing of instruments.
- (2) Battery exchange.
- (3) Deployment of instruments in a crisis period for:
 - (a) Shelter in-place option.
 - (b) Crisis Relocation option.
- (4) Training of shelter monitors during a crisis period.
 - (a) Review of MF-72.
 - (b) Special videotapes for training.

b. RADEF Instruments.

- (1) Develop requirements based on Standards (CPG 1-5).
- (2) Requirements to be based on NCP option for which maximum number is required (obtain State help in making this determination).
- (3) Obtain instruments from State.
- (4) Place instruments in secure storage in bulk repositories. (In non-risk areas, instruments may be placed in selected public shelters).

c. Training of Shelter Monitors.

- (1) Assure that MF-72, Guidance for Shelter Monitoring, is located with each set of instruments for shelters.
- (2) Make arrangements for the crisis training of shelter monitors.

d. Tests and Exercises.

- (1) Exercise instrument deployment procedures.
- (2) Test for operability of instruments in accordance with State's schedule. Have State replace instruments that check out as inoperable.
- (3) Test for adequacy of MF-72 and crisis training procedures.

Chapter 9 Radiological Defense Support for Emergency Services

9.1 Discussion

This guidance is applicable to not only the emergency services organizations of State and local governments, but also to vital facilities and essential industries. Examples of vital facilities are hospitals and utilities. Examples of essential industries include food processing, storage and distribution and pharmaceutical manufacture and supply, which would be required to function early post-attack to save lives and maintain health and safety. This guidance is also applicable to the large numbers of emergency workers that would be required for later postattack recovery operations, including radiological decontamination.

In the event of a nuclear attack, emergency personnel and the staffs of vital facilities and essential industries may be required to function in a fallout radiation environment in the early post-attack period. Also in areas contaminated by fallout, many emergency workers may be required to assist in handling casualties, in removing debris, and performing other recovery operations in a radiation environment. To minimize the radiation risk to personnel involved in these activities, self-protection radiological instrumentation must be available for use by trained individuals. The term "self-protection" as applied to radiological defense means those emergency services, vital facilities, and essential industries having the ability to detect, measure, and assess the radiation environment at their location with the objectives of (a) reporting to their headquarters; (b) determining if and for how long emergency operations can be conducted, and (c) minimizing exposures to personnel in the course of performing their missions.

9.2 Implementation Techniques

The Standards for Local Civil Preparedness, (CPC 1-5), provide guidelines for determining the instrumentation and training requirements. Radiological instrument sets and dosimeters and chargers for self-protection radiological monitoring are available to local jurisdictions, from the States. The present radiological instrument set issued for self-protection radiological monitoring is the CD V-777. It contains one CD V-700 low-range survey meter, two CD V-715 high-range survey meters, six CD V-742 high-range dosimeters, one CD V-750 dosimeter charger, and a Handbook for Radiological Monitors. The instruments available for issue to emergency workers are the CD V-742 high-range dosimeters, and the CD V-750 dosimeter chargers.

The requirement for (1) instrument sets, dosimeters and chargers, and (2) trained radiological monitors for self-protection radiological monitoring is identified in the Program Status Report.

A Monitoring, Reporting, and Assessment (MR&A) capability which is part of the Direction and Control System for conducting emergency operations also supports emergency services, vital facilities, and essential industries. MR&A support is discussed in Chapter 10, Radiological Defense Support for Direction and Control.

9.3 Checklist

a. Procedures

(1) The local Nuclear Emergency Operations Plan provides for procedures for the self-protection radiological monitoring capability, which includes an explanation of the purpose and functions of this capability and how it supports the emergency services, vital facilities, and essential industries within the jurisdiction.

(2) Annexes to the plan should include:

(a) A list of the services, facilities, and industries requiring this capability.

(b) The equipment and trained personnel needed by each activity.

(c) Assignment to the EOC RADEF Operations staff of the responsibility to estimate the exposure of all emergency workers.

(d) Distribution and use of dosimeters and chargers for emergency worker personnel dosimetry.

(e) Reassignment, (under the direction and control of the EOC RADEF Operations staff) in the postattack period, of monitors and equipment from Weapons Effects Reporting stations and shelters to assist emergency workers by providing surveys of the work area, monitoring the effectiveness of decontamination, and other assistance.

(f) Matching of self-protection radiological monitors with the requirements of the emergency services and vital facilities as stated in their respective annexes to the Basic Nuclear Emergency Operations Plan. (As a minimum, they should be in consonance with CPG 1-5.)

(g) Decontaminating vital facilities, including a listing of facilities by priority, decontamination techniques, equipment, and manpower required, Weapons Effects Reporting and shelter monitoring resources (equipment and monitors) to be used, and tentative assignments of personnel.

(b) Provision for maintaining a self-protection radiological monitoring capability that would be operationally ready on a day-to-day basis.

(i) Provision for crisis-augmentation to maximize the emergency operational response capability.

(3) Procedures are required for:

(a) Local storage and servicing of instruments.

(b) Battery exchange.

(c) Deployment of stored instruments during a crisis period.

(d) Establishing and maintaining a ready cadre of trained RADEF monitors for:

(i) Emergency services.

(ii) Vital facilities.

(iii) Essential industries.

(e) Recruitment and assignment of postattack emergency workers.

(f) Crisis training of additional required personnel.

b. RADEF Instruments

(1) Develop requirements based on CPG 1-5.

(2) Obtain instruments from State supplies.

(3) Radiological instrument sets for operationally ready self-protection should be stored in the facility itself or on the emergency vehicle. Sets for expansion of the capability during increased readiness should be stored in local bulk repositories, with plans for crisis distribution.

(4) Emergency worker dosimeters and chargers obtained from the State supply for local use should be stored in bulk repositories and at selected emergency services and vital facilities.

(5) Emergency services, vital facilities, and essential industries should have a communications capability with the EOC or with the service's central dispatch. (This enables emergency service units to (i) receive information and guidance on the radiation environment; (ii) be assigned missions, and (iii) report conditions encountered in performing their missions.)

(6) Provide a plan and procedures for the operational testing of all instruments in a crisis period.

c. Facilities

Provide for emergency services, vital facilities, and essential industry personnel to be sheltered against excessive radiation from fallout. Personnel should be located in a nearby shelter if an adequate shelter is not available within the normal facility. (Since these personnel will be required to perform their services during periods of relatively high radiation, they should have a shelter with the highest radiation protection possible.)

d. Personnel

(1) Determine the total requirements for RM's and RDO's for the Self-Protection Radiological Monitoring Capability.

(a) Determine the number of personnel that require training as RM's for each emergency service, vital facility, and essential industry requiring self-protection radiological monitoring. Identify an operationally ready cadre requirement and a crisis-augmentation requirement.

(b) Those emergency services, vital facilities and essential industries which are organized to receive emergency assignments from a central location (such as a central dispatch for fire units, a central office for State or local police, or a central dispatch for telephone repair vehicles or city maintenance vehicles) should have one or more of their staff at this central office trained as an RDO in order to provide more comprehensive radiological guidance to their personnel. (This is the concept of the self-protection RDO.)

e. Training

(1) Provide for the training of the operationally ready cadre of personnel over a reasonable period of time. Provide a schedule for this training.

(2) Schedule courses so that the ES-3 HOME STUDY phase can be coordinated with the RM-PRACTICAL phase.

(3) Provide a plan, to include procedures and materials, for the crisis training of personnel to fulfill the requirements over and above the number required for the operationally ready cadre.

(4) Provide for periodic refresher training. This could be in the form of tests and/or exercises.

(5) Provide for the local availability of RM training.

(a) Recruit and maintain a local RM instructor (can be the local RDO).

(b) Services such as a police or fire academy that include RM training as part of their overall training program should have one or more of their training staff qualified as an RM Instructor.

(6) Obtain and maintain a stock of training materials.

(7) Provide for availability of CD V-784 radiation training source set(s) from State.

f. Tests and Exercises

(1) Test personnel and equipment by having operational checks made on all instruments. Arrange with the State for the exchange of defective instruments.

(2) Test the deployment of emergency worker dosimeters and chargers.

(3) Exercise emergency services in the context of a peacetime radiological incident, as well as a nuclear attack scenario.

Chapter 10
Radiological Defense Support for Direction and Control

10.1 Discussion

a. This guidance pertains to RADEF support directly to the Direction and Control capability of civil preparedness. It describes a Monitoring, Reporting, and Assessment (MR&A) capability for providing decision-makers with information on the radiation environment resulting from a nuclear attack. Through Emergency Public Information, the MR&A capability also indirectly supports shelterees, emergency services, vital facilities, and essential industries. Under the basic Emergency Operations Plan, all of these would look to the local decision-makers for guidance and instructions, including radiological intelligence and guidance.

b. A MR&A capability is composed of the following:

- (1) EOC with adequate fallout protection.
- (2) Trained EOC RADEF staff-RDO plus plotters and analysts.
- (3) A network of Weapons Effects Reporting (WER) stations.
- (4) Reliable communications between WER stations and the EOC.
- (5) Radiological instruments located in the WER stations.
- (6) Trained monitors located at the WER stations.
- (7) An Emergency Public Information (EPI) plan for providing guidance about fallout radiation hazards to the public.
- (8) Aerial Radiological Monitoring support by the State.

c. From the foregoing it can be seen that trained personnel and radiological instruments alone do not provide for a MR&A capability. Therefore, it is necessary to provide for all components of the capability when developing and implementing a RADEF program.

d. The WER network is required not only to provide radiological information to the EOC and decision-makers, but also to provide RADEF guidance for shelterees, the emergency services, vital facilities, and essential industries; and for the large numbers of emergency workers that would be required for postattack recovery operations.

e. The Standards for Local Civil Preparedness (CPG 1-5) prescribe general criteria for the MR&A capability. Additional detailed guidance is given in 10.3 in the form of a checklist.

f. The recommended radiological instrument set to be issued for WER stations is the CD V-777A. The recommended complement of instruments in the CD V-777A is: 1 CD V-700 low-range survey meter, 1 CD V-715 high-range survey meter, 1 CD V-717 high-range remote-indicating survey meter, 6 CD V-742 high-range dosimeters, and 1 CD V-750 dosimeter charger. The set also contains a detailed "Handbook for Radiological Monitors." Instruments procured for this purpose by the Federal Government have been made available to the States.

10.2 Implementation Techniques

a. Local Level

(1) The Weapons Effects Reporting (WER) stations are strategically located to provide the EOC RADEF Operations section with data on the exposure rate (radiation environment) throughout the jurisdiction. Station locations should be selected to maximize the gathering of radiological information in densely populated areas, as well as to give adequate geographic coverage, even in sparsely populated areas. Specific guidance on the minimum number of stations recommended is detailed in CPG 1-5. Individual station locations should be selected first based upon their communications capability. Maximum use should be made of two-way radio where telephone backup can be available. Locations should be selected secondly for their existing fallout protection (or where fallout protection can readily be upgraded to be adequate). Emphasis should also be on the use of personnel and facilities from local governmental organizations and emergency service organizations.

(2) The Shelter Radiological Monitoring capability and Self-Protection Radiological Monitoring capability are described in Chapter 7, The RADEF System. The MR&A capability should be established in conjunction with both of these related capabilities. However, radiological equipment, trained monitors, and communications must be dedicated first to the MR&A capability. Thus, the main item of commonality would be the facility; that is, the shelter, fire house, police station, or hospital, as applicable. It is likely that the instruments and trained monitors could also be used for the Shelter Radiological Monitoring capability. However, they could only support the Self-Protection Radiological Monitoring capability if they were considered to be a "base station" type of operation. Thus, they could not leave the facility as most self-protection radiological monitoring instruments and personnel would.

(3) The EOC RADEF Operations section, as part of the Direction and Control capability, is the focal point for radiological intelligence within the jurisdiction. The RADEF staff, based upon weapon detonation information received from the State, predicts the arrival of radioactive fallout in the jurisdiction. After fallout has arrived, radiological instrument readings are received from each of the individual WER stations.

(4) Notification (confirmation) of fallout arrival is flashed to adjacent communities and the State EOC. These data are analyzed to determine the radiation environment of the jurisdiction. Information on the radiation environment is forwarded to State level in accordance with procedures established by the State.

(5) Radiological information developed by the MR&A capability is combined with other information and is used by the EOC staff in Direction and Control for determining (a) if and when emergency operations can be initiated; (b) when lower grade shelters may be used; (c) when emergency services personnel, emergency workers, or any others being sheltered - may go outside of shelters; (d) when restrictions in shelter living may be relaxed; and (e) when radiological countermeasures should be undertaken.

b. State Level

(1) At the State level, the Monitoring, Reporting and Assessment capability is somewhat more complex than at the local level. The RADEF staff, based upon information received from a variety of sources including DCPA Regions and the military, predicts the arrival of radioactive fallout for locations within the State. This information is disseminated in the form of fallout warning messages to the affected local jurisdictions. The State RADEF Operations section receives information from the local EOC RADEF Operations concerning (a) nuclear weapons detonations (NUDETS) and (b) exposure rate data from throughout the local jurisdiction. Within the State RADEF Operations section, the local jurisdictions data are analyzed to determine the overall radiation environment throughout the State. Information on the radiation environment is distributed to the local jurisdictions in accordance with State procedures.

(2) Aerial Radiological Monitoring (ARM) is part of the State level RADEF MR&A. The State RADEF Operations section controls the initiation of all aerial radiological surveys within the State. Aerial radiological surveys provide the State with the ability to cover relatively large areas. Such areas include (a) where the radiation intensity is too high to permit ground monitoring; (b) where no local monitoring capability exists; and/or (c) where no data are available. Aerial radiological surveys can also be used to monitor evacuation routes, supply routes, etc., which may cover more than one local jurisdiction. Although the aerial radiological

monitoring function is part of the State RADEF System, aerial radiological monitoring teams should be located at dispersed locations throughout the State. The number and location will depend primarily upon the State's geography, airport and aircraft availability, and population distribution. Aerial radiological monitoring may also be used by a local jurisdiction to obtain RADEF information on remote areas within the jurisdiction or areas where the WER stations are not functioning. However, since ARM is part of the State system, these activities should be coordinated with the State RADEF Operations.

(3) A network of WER stations is generally considered to be part of a local monitoring, reporting, and assessment capability. However, there may be circumstances in which a WER network is developed with reporting being directly to State level. A State level WER network may be developed in conjunction with a State agency such as State Police or Highway Patrol, State Department of Highway Maintenance, State Forestry Service, or State Fish and Game, etc. In such case, the WER network can provide data for their agencies to use, as well as to provide data on areas not covered by a local WER network. In risk areas, it may be advisable to have a State WER network as back-up to local jurisdictions in the event a local jurisdiction's RADEF capability is very limited or becomes inoperable. The WER stations that are part of the State level WER network should also report their data to the local jurisdiction as well as to the State. This will provide the local jurisdiction with additional data which, in conjunction with data from their own WER stations, will result in a more complete "picture" of the radiation hazard.

(4) Weapons effects reports from local jurisdictions are analyzed and summaries are forwarded to DCPA Region in accordance with established DCPA reporting procedures. All weapons effects information and RADEF information is used by the State EOC staff and decision-makers to determine and recommend what remedial action or countermeasures should be taken and when and where within the State.

10.3 Checklist

a. Procedures

The Basic Emergency Operations Plan explains the purpose and functions of the EOC RADEF Operations and the WER network. It contains the following:

(1) Identification of the duties and functions of the EOC RADEF Operations staff; and the personnel assigned, including their names, addresses, telephone numbers, functions (duties), and training.

(2) Description of the frequency and type of radiological information to be reported, and the reporting procedures. (Generally, the local jurisdiction will require more detailed data from the WER stations than will be reported to county or State levels.)

(3) Identification of the Weapons Effects Reporting stations that comprise the operationally ready WER network, their locations, and the monitors assigned to each location, including names, addresses, telephone numbers, and training.

(4) Identification of Self-protection and shelter monitoring locations that could be used as backup or added to the operationally ready WER network.

(5) Procedures for crisis expansion of the MREA capability and training of additional RM's, RDO's, and the EOC RADEF staff.

(6) Provision for Aerial Radiological Monitoring support to local EOC's.

(7) In addition, at State level, identify the number of locations from which aerial radiological monitoring missions would originate, their addresses, the types and quantity of aircraft available for use at each location, the aerial radiological monitoring equipment available and its storage location, procedures for initiating a survey - including obtaining the necessary authorizations - and reporting procedures.

b. Facilities

(1) The EOC is a facility equipped and staffed to provide for RADEF Operations as a part of an overall Direction and Control capability.

(2) The WER stations are located to give adequate geographical coverage for each jurisdiction based on CPG 1-5, Standards for Local Civil Preparedness.

(3) In addition, at State level, the facilities required for aerial radiological monitoring include shelters for the personnel, airfields, aircraft and their supporting equipment (gas, oil, etc.) and protection for the aircraft from fallout and other nuclear weapons effects. Ideally, these facilities should be located in areas at low risk from blast and fire.

c. Equipment

(1) Develop requirements based on CPG 1-5.

(2) Provide for dependable communications from each WER station to the EOC for reporting data.

- (3) Obtain instrument sets.
- (4) Provide each WER station with at least one CD V-777A set of RADEF instruments.
- (5) Store sets in operationally ready WER stations.
- (6) Store additional RADEF instrument sets for crisis expansion of the WER network in local bulk repositories throughout the State, with plans for distribution during crisis augmentation.
- (7) Assure that EOC RADEF Operations staff has radiological instruments in order to perform radiological surveys within and outside the EOC.
- (8) Assure that the EOC RADEF Operations area has appropriate maps and supplies required, including templates, for plotting (DP) wind data, nuclear detonations (NUDETS), and radiation exposure rates.
- (9) Provide for periodic operational check of the instruments by the radiological monitors. This may be in conjunction with a local test or exercise.
- (10) In addition, at State level, obtain required number of CD V-781, aerial radiological monitoring sets.
 - (a) Store sets at or near the airports from which flights would originate.
 - (b) Provide for periodic replacement of batteries, maintenance and calibration check of instruments.

d. Personnel

- (1) Provide for at least one trained Radiological Defense Officer (RDO) to be operationally ready to perform the duties of an RDO in the event of an attack with little or no warning.
- (2) Provide for additional trained RDO's in accordance with CFG 1-5.
- (3) Provide for trained and assigned radiological monitors (RM's) for each operationally ready WER station.
- (4) Provide for the crisis training of additional RM's for these stations, and also RM's for crisis-augmented WER stations.
- (5) In addition, at State level, provide for trained aerial radiological monitors to be operationally ready and assigned to

each aerial monitoring set. CPG 1-5 establishes the minimum requirement for aerial radiological monitors. However, if an organization such as the Civil Air Patrol volunteers their services, it is customary to train all interested personnel rather than limit the training to the minimum number required to establish a capability. This approach is also recommended in order to allow for normal attrition.

Chapter 11
Radiological Decontamination

11.1 Discussion

a. Radiological decontamination is the reduction or removal of radioactive material from a structure, area, object, or person. The objective of decontamination is to reduce radiation exposure to an acceptable level with the lowest feasible expenditure of labor and materials, while limiting the radiation exposure of decontamination personnel to a minimum commensurate with the urgency of the task. Radioactivity cannot be destroyed, but in the event of nuclear attack, the fallout radiation hazard could be reduced by: (1) removing radioactive particles from a contaminated surface and away from the area of immediate concern; (2) covering the contaminated surface with shielding material, such as earth, or; (3) isolating a contaminated object and waiting for the radiation level to decrease through the process of radioactive decay.

b. Certain vital facilities and industries, such as communication centers, emergency government facilities, essential public utilities, and essential equipment could require early decontamination. Personnel decontamination should be initiated promptly. It should be possible to defer many decontamination activities until the latter part of the operational recovery phase.

c. Decontamination may be partial or complete. Partial decontamination usually involves the rapid, partial removal or covering of contamination to reduce the radiation exposure rate as quickly as practicable. Partial decontamination is employed to reduce radiation exposure to a level where priority work can be accomplished with reasonable safety. Complete decontamination would be accomplished subsequently as required to reduce the radiation hazard further. Its employment would be based on the relative importance of the contaminated areas or objects and on other considerations such as work-hours required, resources available and alternative possible solutions. Primarily, decontamination would be employed to permit earlier reactivation of vital facilities and essential industries. To a limited degree, it could be used to improve the protection of some shelters.

d. Important factors to be considered when performing decontamination are: (1) radioactivity cannot be destroyed; (2) the surface to be decontaminated greatly influences the method to be used; (3) in decontaminating, proceed from the easy to the most difficult method; and (4) monitor periodically for effectiveness.

11.2 Implementation Techniques

a. Methods of Decontamination

(1) The method of decontamination applied will depend on many factors. For example: the extent of contamination, type of surface

contaminated, weather, availability of decontamination personnel, materials, and equipment should be considered. Methods for decontaminating personnel, clothing, food, agricultural land, water, vehicles, equipment, vital areas, and structures are described in CPG 2-6.2, Radiological Defense Manual.

(2) The goals of decontamination are to (a) rapidly remove a minimum of material while removing nearly all of the radioactive particles and (b) keep radiation exposures to a minimum consistent with operational requirements. Therefore, mechanical methods are usually performed first to remove the most material the fastest. If dry methods are to be used, such as street sweepers, they must be used before wet methods such as flushing with fire hoses. Hand operations, such as shoveling would normally be performed last.

b. Planning for Decontamination

(1) Chapter 7 contains guidance for planning and preparing for decontamination of vital areas and structures. SM-11.25, Basic Radiological Defense Officer Student Manual and SM-11.26, Advanced Radiological Defense Officer Student Manual contain information and exercises on decontamination procedures and their relative effectiveness. Exercises in developing a decontamination plan for a facility are included.

(2) An annex should be prepared listing the essential facilities and industries in the jurisdiction along with a priority ranking for returning them to an operational status. Facilities and industries that have no, or little, physical damage could become operational if the radiation environment is reduced to allow operating personnel to return without subjecting them to prohibitive radiation exposures. The annex should also contain a listing of the resources available within the jurisdiction for accomplishing decontamination. Such a listing of resources should include the various types of construction equipment, highway maintenance equipment, fire trucks with pumping capability and hose, etc., and the number and location of each item.

(3) A plan for each facility should be developed indicating the decontamination procedures that could be used. These plans would include the estimated types and quantity of resource equipment needed and the number of personnel work-hours required to accomplish the decontamination.

(4) Each plan should include the use of radiological monitoring teams and survey equipment from shelters, monitoring and reporting stations, and self-protection units to perform radiological surveys. These surveys will determine the need for decontamination and the adequacy of the decontamination procedures, as well as to control the radiation exposure of the emergency workers.

c. Responsibility for Decontamination

(1) The Department of Public Works or other engineering departments of State and local governments should be assigned the major responsibility for developing and executing decontamination operations. The radiological decontamination capability must be developed in consonance with the responsible department.

(2) The RADEF officer for the locality should provide technical guidance on radiological decontamination procedures and methods. He should have a major role in the selection of facilities and industries for which decontamination is planned.

d. Personnel and Training Requirements

(1) A decontamination specialist should be available at all but the smallest civil defense organization. The RADEF officer, or his assistant, may be required to perform this function in small jurisdictions. The decontamination specialist should be responsible for planning and implementing decontamination capabilities. He should be an engineer, such as a city engineer, public works engineer, industrial safety supervisor, or other technically qualified person having some administrative capability. Architects and engineers who have completed the course "Fallout Shelter Analysis" would have an excellent background for becoming decontamination specialists. TR-71, Decontamination Consideration for Architects and Engineers, has been prepared specially to advise on how structures can be designed to facilitate postattack decontamination operations. Personnel in the public works or other engineering departments which have a major assigned responsibility for developing and executing decontamination operations should complete the RADEF officer training.

(2) Decontamination workers, such as firemen, sanitation and construction workers, and their auxiliaries should be assigned to perform the basic decontamination work. Personnel selected for performing decontamination operations should be those normally having special skills applicable to decontamination procedures (bulldozer and heavy equipment operators, firemen, etc.) and should be assigned to appropriate decontamination operations. Decontamination personnel would only be trained during an increased-readiness period. These personnel primarily need guidance on (a) how to measure and minimize their radiation exposure while performing decontamination operations; (b) the objective of and order of performing decontamination operations - that is rapidly removing a minimum of material but nearly all of the radioactive particles; (c) and the disposal or relocation of the contaminated material. If additional time is available,

they can be given an orientation on weapons effects and fallout distribution, radiation hazards, and general protection methods so they could better understand the need for decontamination and how to most effectively accomplish decontamination. However, the primary emphasis needs to be placed on applying their specific skills to the decontamination operation they will be performing.

e. Radiation Monitoring and Exposure Control

(1) A means of measuring radiation exposure rates and accumulated exposures should be provided, and individual radiation exposures should be recorded.

(2) The radiological monitoring required to evaluate the need for and effectiveness of decontamination should be provided by radiological monitoring teams from weapons effects reporting stations, self-protection radiological monitoring, and shelters.

(3) Dosimeters and chargers are provided, through the State, to local jurisdictions for use by workers assigned to tasks in radiation areas. (See Chapter 7 D on Self-Protection Radiological Monitoring Capability.) These instruments are designed to measure accumulated radiation exposures; and, as such, serve as a basis for exposure control for the workers who wear them. Guidance on radiation exposure is contained in MCRP Report No. 42, Radiological Factors Affecting Decision-Making in a Nuclear Attack.

11.3 Checklist

The RADEF Annex to the Basic Emergency Operations Plan should include the following:

a. A listing of essential facilities and industries within the jurisdiction that may require decontamination, and a priority ranking for returning them to operational status.

b. A listing of resources available for accomplishing decontamination, such as various types of construction equipment, highway maintenance equipment, and fire trucks. Include the quantity and location of each item.

c. A listing of the decontamination procedures that could be used for each facility, including the estimated types and quantities of equipment needed, and the number of personnel and work-hours required to accomplish the decontamination.

d. A listing of radiological monitoring teams and survey equipment from shelters, weapons effects reporting stations, and self-protection units that could be used to perform surveys to determine the need for decontamination procedures, and to limit the radiation exposure of the emergency workers.

e. A listing of the bulk storage locations for emergency worker dosimeters and chargers, the quantities at each location, and distribution plans.

f. A listing of decontamination specialists and the agencies responsible for conducting decontamination operations.

g. An evaluation for each facility listed in a. above for the sheltered area of concern for the source of the radiation contribution (overhead, ground, and skyshine).

The State and local jurisdictions should work together to implement a radiological decontamination capability based on the above guidance and checklist.

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